CLAIMS

What is claimed is:

1. A gas turbine engine combustor component comprising:

a characteristic thermal-mechanical stress principal direction; and

a single crystal substrate having a lowest modulus direction within 15° of said principal direction.

2. The component of claim 1 used as a gas turbine engine component selected from the group consisting of:

combustor shell pieces; and

combustor heat shield pieces.

3. The component of claim 1 having an overall shape of a frustoconical shell segment.

4. A gas turbine engine including a plurality of components according to claim 3 used as combustor heat shield pieces.

5. The component of claim 1 further comprising

at least a partial coating on the substrate.

6. The component of claim 1 wherein:

said crystalline structure is face-centered cubic.

7. The component of claim 1 wherein:

said crystalline structure consists essentially of a nickel-based superalloy.

8. The component of claim 1 wherein said nickel-based superalloy has, by weight percent:

1.0-12.0 Cr;

5.0-20.0 Co;

4.0-10.0 Ta;

5.3-6.5 Al; and

5.5-10.0 W; and

a gamma prime (γ') volume fraction in excess of 50%.

9. A combustor panel characterized by:

a substrate having an overall shape of a frustoconical segment; and

a single crystal grain structure of the substrate having a lowest modulus first direction within 30° of:

a central characteristic circumferential direction if a cone half angle of the panel has a magnitude less than 45°; or .

a central characteristic conewise direction if the cone half angle of the panel has a magnitude greater than 45°.

10. The panel of claim 9 further characterized by:

said lowest modulus first direction being within 15° of said central characteristic circumferential direction; and

a lowest or second lowest modulus second direction within 30° of a central characteristic surface longitudinal direction.

11. The panel of claim 9 used in a gas turbine engine.

12. The panel of claim 9 further characterized by:

the cone half angle being -30° to 30°.

13. The panel of claim 9 further characterized by:

the cone half angle being +/-(5° to 30°).

14. The panel of claim 9 further characterized by:

the cone half angle having a magnitude in excess of 60°; and

the panel having a swirler aperture having a linear dimension of at least 25% of at least one of a local circumferential or local radial span.

15. The panel of claim 9 wherein:
the substrate consists essentially of a nickel-based superalloy

16. The panel of claim 9 further characterized by:
first and second edges essentially extending circumferentially; and
third and fourth edges essentially extending in longitudinal/radial planes.

17. The panel of claim 9 further characterized by:
a characteristic circumferential span of 20° to 60°.

18. The panel of claim 9 further characterized by:
a longitudinal span of 30mm to 200mm.

19. A method for engineering combustor component subject to thermal-mechanical fatigue comprising:
determining a characteristic thermal-mechanical stress principal direction; and
fabricating the component so as to comprise a single crystal substrate having a lowest modulus direction within a target alignment with said principal direction.

20. The method of claim 19 wherein:
said target alignment is within 15° of said principal direction.

21. The method of claim 19 wherein:
the determining comprises a simulation.

22. The method of claim 19 used to reengineer a replacement for an original component.

23. The method of claim 22 wherein:

the replacement has an elastic modulus in said principal direction of less than twenty Msi (138 GPa); and

the original article has an elastic modulus in said principal direction of greater than thirty Msi (207 GPa).

24. The method of claim 19 further comprising determining a thermal-mechanical stress secondary direction and wherein said fabricating provides said substrate with a second direction, also being a lowest modulus direction.

25. The method of claim 19 further comprising:

applying at least a partial coating to the substrate.